1. An apparatus for coating both sides of a metal strip with polymer, comprising:

a preheater for heating an uncoated metal strip;

first and second pairs of rolls located downstream of the preheater, with each pair of rolls including a casting roll and a backup roll, and with the casting roll and backup roll for each pair of rolls forming a nip for moving the metal strip therethrough;

first and second extrusion dies located above, respectively, the first and second pairs of rolls, with the extrusion dies disposed to extrude molten polymer webs onto opposite sides of the metal strip substantially at the roll nips or just ahead of the roll nips, and with the roll nips configured to press the polymer webs to the opposite sides of the metal strip to adhere the polymer webs to the metal strip;

a reheater located between the first and second pairs of rolls for reheating the metal strip and polymer web deposited thereon as the metal strip passes between the first and second pairs of rolls;

a postheater located downstream of the first and second pairs of rolls for heating the coated metal strip and enhancing the bonding between the polymer webs and the opposite sides of the metal strip; and

a quenching device located downstream of the postheater for quickly cooling the coated metal strip after the coated metal strip moves through the postheater.

2. The apparatus of claim 1 wherein the extrusion dies are disposed to extrude the molten polymer webs onto the opposite sides of the metal strip up to about 25° of rotation of the casting roll ahead of the roll nips.

3. The apparatus of claim 1 further including flame heaters located upstream of the first pair of rolls for flame treating the opposite sides of the metal strip to enhance bonding of the polymer webs to the opposite sides of the metal strip.

4. The apparatus of claim 1 wherein the quenching device uses one of cooling water and cooling air as the quenching medium.

5. The apparatus of claim 1 wherein the quenching device is a water bath, and wherein the apparatus further includes a drying device located downstream of the water bath for drying the coated metal strip as it exits the water bath.

6. The apparatus of claim 1 wherein the extrusion dies are positioned approximately 4 to 12 inches above the first and second pairs of rolls.

7. The apparatus of claim 1 wherein the extrusion dies each define a die opening slot for extruding the polymer webs onto the opposite sides of the metal strip, and wherein the die opening slot for each extrusion die has an opening width of between approximately 0.005 to 0.030 inch.

8. The apparatus of claim 1 wherein at least one of the casting rolls for each pair of rolls is a hard metal roll having a chrome metal roll surface.

9. The apparatus of claim 1 wherein at least one of the casting rolls for each pair of rolls is a hard metal roll having a roll surface made of a material selected from the group consisting of chrome plating, chrome oxide, and aluminum oxide.

10. The apparatus of claim 1 wherein at least one of the backup rolls for each pair of rolls has a resilient roll surface made of high temperature resistant elastomer.

11. The apparatus of claim 1 wherein at least one of the backup roll and casting roll for each pair or rolls has a resilient roll surface made of high temperature resistant elastomer.

12. The apparatus of claim 1 wherein at least one of the backup rolls for each pair of rolls has a resilient roll surface made of a material selected from the group consisting of silicone rubber, polyurethane, chlorotrifluorethylene polymers, and tetrafluoroethylene fluorocarbon polymers.

13. The apparatus of claim 12 wherein the material comprising the resilient roll surface has a Durometer hardness of about 75-85 shore A.

14. The apparatus of claim 1 wherein the at least one of the backup rolls for each pair of rolls is comprised of one of natural and synthetic rubber and has a roll surface made of a material selected from the group consisting of silicone rubber, polyurethane, chlorotrifluorethylene polymers, and tetrafluoroethylene fluorocarbon polymers.

15. The apparatus of claim 1 wherein at least one of the casting rolls for each pair of rolls has a resilient roll surface made of a material selected from the group consisting of silicone rubber, polyurethane, chlorotrifluorethylene polymers, and tetrafluoroethylene fluorocarbon polymers.

16. The apparatus of claim 1 where the casting roll and backup roll for each pair of rolls have smooth roll surfaces in a range of about 2-20 root-mean-square.

17. The apparatus of claim 1 further including a cooling support roll in contact with the backup roll for each pair of rolls.

18. The apparatus of claim 1 wherein the first pair of rolls is disposed higher than the second pair of rolls such that the metal strip travels downward from the first pair of rolls to the second pair of rolls.

19. The apparatus of claim 18 wherein the second pair of rolls is horizontally offset from the first pair of rolls such that the metal strip travels downward from the first pair of rolls to the second pair of rolls and at angle to vertical.

20. The apparatus of claim 18 wherein the second pair of rolls is horizontally offset from the first pair of rolls, and further including a turn roll located between the first and second pairs of rolls for changing the direction of the metal strip as it travels downward from the first pair of rolls to the second pair of rolls.

21. The apparatus of claim 18 wherein the second pair of rolls is aligned along a substantially vertical axis with the first pair of rolls such that the metal strip travels substantially vertically downward from the first pair of rolls to the second pair of rolls.

22. The apparatus of claim 18 wherein the second pair of rolls is horizontally offset from the first pair of rolls such that the metal strip travels from the first pair of rolls to the second pair of rolls in a substantially horizontal plane.

23. The apparatus of claim 1 wherein each pair of rolls is configured to exert a roll nip compression force of between about 50 to 300 pounds per linear inch on the metal strip.

24. The apparatus of claim 1 wherein the casting rolls and backup rolls for the first and second pair of rolls are operable to rotate at a higher surface velocity than the velocity of the molten polymer webs exiting the extrusion dies, thereby drawing the polymer webs applied to the metal strip to a reduced thickness.

25. The apparatus of claim 24 wherein a ratio of the surface velocity of the casting rolls and backup rolls to the velocity of the molten polymer webs exiting the extrusion dies is between about 5:1 to 200:1.

26. The apparatus of claim 1 wherein the casting roll and backup roll for each pair of rolls have centers offset vertically from each other.

27. The apparatus of claim 1 wherein the casting roll and backup roll for at least one of the pairs of rolls have centers offset vertically from each other.

28. The apparatus of claim 2 wherein the casting roll and backup roll for each pair of rolls have centers offset vertically from each other.

29. The apparatus of claim 2 wherein the casting roll and backup roll for at least one of the pairs of rolls have centers offset vertically from each other.

30. The apparatus of claim 1 wherein casting roll for each pair of rolls is internally cooled.

31. The apparatus of claim 1 further including a takeoff roll located on an opposite side of the casting roll from the backup roll for each pair of rolls, the takeoff roll forming a second roll nip with the casting roll for each pair of rolls, and the metal strip passing through the second roll nip for each pair of rolls such that the metal strip wraps around a portion of the roll surfaces of each of the casting rolls.

32. An apparatus for coating both sides of a metal strip with polymer, comprising:

a preheater for heating an uncoated metal strip;

a pair of casting rolls located downstream of the preheater, with the casting rolls forming a nip for moving the metal strip therethrough, and with the casting rolls each having a resilient roll surface for contacting the metal strip;

first and second extrusion dies located above, respectively, the casting rolls, with the extrusion dies disposed to extrude molten polymer webs onto opposite sides of the metal strip substantially at the roll nip formed by the casting rolls or just ahead of the roll nip, and with the roll nip configured to press the polymer webs to the opposite sides of the metal strip to adhere the polymer webs to the metal strip;

a postheater located downstream of the casting rolls for heating the metal strip and enhancing the bonding between the polymer webs and the opposite sides of the metal strip; and

a quenching device located downstream of the postheater for quickly cooling the coated metal strip after the coated metal strip moves through the postheater.

33. The apparatus of claim 32 further including a pair of cooling support rolls located adjacent and in contact with, respectively, the casting rolls.

34. The apparatus of claim 32 wherein the casting rolls are operable to rotate at a substantially higher surface velocity than the velocity of the molten polymer webs exiting the extrusion dies, thereby drawing the polymer webs applied to the metal strip to a reduced thickness.

35. The apparatus of claim 34 wherein a ratio of the surface velocity of the casting rolls to the velocity of the molten polymer webs exiting the extrusion dies is between about 5:1 to 200:1.

36. The apparatus of claim 32 wherein the casting rolls each have a resilient roll surface made of a material selected from the group consisting of silicone rubber, polyurethane, chlorotrifluorethylene polymers, and tetrafluoroethylene fluorocarbon polymers.

37. The apparatus of claim 32 wherein the roll nip formed by the casting rolls is aligned along a substantially vertical axis such that the metal strip travels substantially vertically through the roll nip.

38. The apparatus of claim 32 wherein the quenching device uses one of cooling water and cooling air as the quenching medium.

39. The apparatus of claim 32 wherein the casting rolls each have a resilient roll surface made of high temperature resistant elastomer.

40. The apparatus of claim 32 wherein the extrusion dies each define a die opening slot for extruding the polymer webs onto the opposite sides of the metal strip, and wherein the die opening slot for each extrusion die has an opening width of between approximately 0.005 to 0.030 inch.

41. An apparatus for coating both sides of a metal strip with polymer, comprising:

a preheater for heating an uncoated metal strip;

a pair of applicator rolls located downstream of the preheater, with the applicator rolls forming a roll nip for moving the metal strip therethrough;

a pair of pinning and drawing rolls located adjacent, respectively, the applicator rolls;

first and second extrusion dies located above, respectively, the pinning and drawing rolls, with the extrusion dies disposed to extrude molten polymer webs onto the roll surfaces of the pinning and drawing rolls, with the pinning and drawing rolls operable to rotate at a higher surface velocity than the velocity of the molten polymer webs exiting the extrusion dies, thereby drawing the polymer webs to a reduced thickness prior to passing the polymer webs to the applicator rolls, and with the roll nip formed by the applicator rolls configured to press the polymer webs to opposite sides of the metal strip to adhere the polymer webs to the metal strip;

a postheater located downstream of the applicator rolls for heating the metal strip and enhancing the bonding between the polymer webs and the opposite sides of the metal strip; and

a quenching device located downstream of the postheater for quickly cooling the coated metal strip after the coated metal strip moves through the postheater.

42. The apparatus of claim 41 further including a pair of cooling and polishing rolls located between and separating, respectively, the applicator rolls and the pinning and drawing rolls, with the cooling and polishing rolls configured to cool and polish the polymer webs by rolling contact between the cooling and polishing rolls and the polymer webs prior to their application by the applicator rolls to the metal strip.

43. The apparatus of claim 41 further including a cooling and turning roll located between the applicator rolls and the postheater for cooling the coated metal strip and changing its direction of travel after exiting the applicator rolls.

44. The apparatus of claim 43 wherein the cooling and turning roll includes an inner shell and an outer shell spaced from the inner shell, with the inner and outer shells defining an annular chamber therebetween at least partially filled with a cooling liquid for cooling the metal strip as it passes over the cooling and turning roll.

45. The apparatus of claim 44 wherein the quenching device is a second cooling and turning roll.

46. The apparatus of claim 41 further including flame heaters located upstream of the applicator rolls for flame treating the opposite sides of the metal strip to enhance bonding of the polymer webs to the opposite sides of the metal strip.

47. The apparatus of claim 41 wherein the quenching device is a water bath, and wherein the apparatus further includes a drying device located downstream of the water bath for drying the coated metal strip as it exits the water bath.

48. The apparatus of claim 41 wherein a ratio of the surface velocity of the pinning and drawing rolls to the velocity of the molten polymer webs exiting the extrusion dies is between about 5:1 to 200:1.

49. The apparatus of claim 41 wherein the roll nip formed by the applicator rolls is aligned along a substantially vertical axis such that the metal strip travels substantially vertically through the roll nip.

50. The apparatus of claim 41 wherein at least one of the applicator rolls has a resilient roll surface made of high temperature resistant elastomer.

51. The apparatus of claim 41 wherein at least one of the applicator rolls has a resilient roll surface made of a material selected from the group consisting of silicone rubber, polyurethane, chlorotrifluorethylene polymers, and tetrafluoroethylene fluorocarbon polymers.